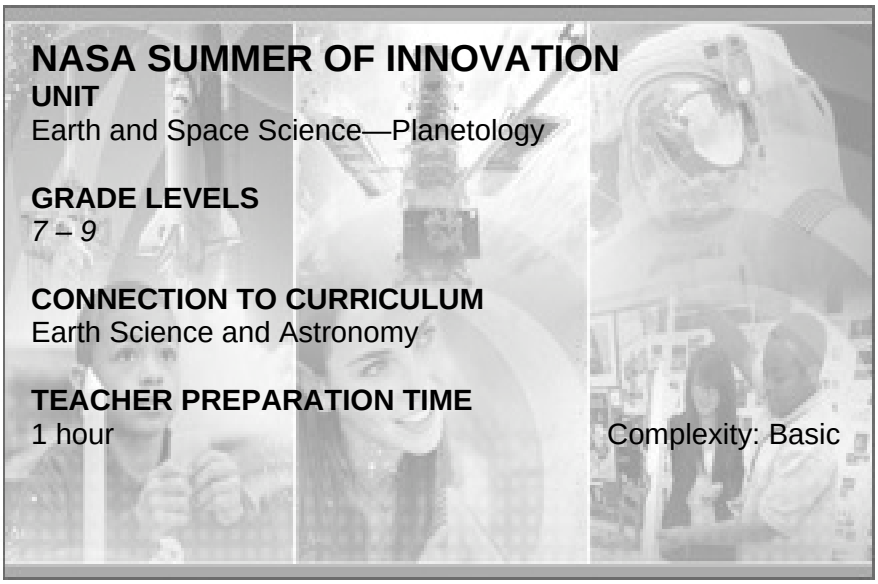
How Does Earth Compare?



NASA SUMMER OF INNOVATION

UNIT
Earth and Space Science—Planetology

GRADE LEVELS
7 – 9

CONNECTION TO CURRICULUM
Earth Science and Astronomy

TEACHER PREPARATION TIME
1 hour

Complexity: Basic

LESSON DESCRIPTION
This lesson combines a series of activities together to compare models of the size of Earth to other planets and the distances to other planets. Activities highlight space missions to other planets in our solar system.

OBJECTIVES
Students will

- Use models to compare sizes of planets and measure the distances of the planets from the Sun
- Describe the different space missions to other planets in our solar system

NATIONAL STANDARDS

National Science Education Standards (NSTA)
Earth and Space Science Standards

- Origin and evolution of the Earth system
- Structure of the Earth system
- Earth in the solar system

History and Nature of Science

- Science as a human endeavor

Common Core State Standards for Mathematics (NCTM)
Ratios and Proportional Relationships

- Analyze proportional relationships and use them to solve real-world and mathematical problems

Expressions and Equations

- Understand the connections between proportional relationships, lines, and linear equations

U.S. National Geography Standards (NCGE)
The World in Spatial Terms

- How to use mental maps to organize information about people, places, and environments on the Earth's surface
-

ISTE NETS and Performance Indicators (ISTE)
Creativity and Innovation

- Apply existing knowledge to generate new ideas, products, or processes

Critical Thinking, Problem Solving, and Decision Making
Use multiple processes and diverse perspectives to explore alternative solutions

MANAGEMENT

This activity has two parts, each of which can be completed in one class period. Part 1 looks at the sizes of the planets and takes place in the classroom. Students predict the size of Earth and Jupiter and find foods (like cereal, gum balls, marshmallows, etc.) that are about the size of each planet. The foods are listed in the Materials List on the Student Worksheet. These choices are only suggestions; other foods will also work as models. Use whatever is convenient. Another activity for Part 1 is to have three balloons provided to students in groups of threes. One student will inflate a balloon that would be the scale of Earth. The other two students are to inflate the balloons to scale that would represent Mars and the Moon.

Part 2 requires the class to go outside to walk the distances between the planets. If possible, find a long stretch of land to walk the 600 meters. If not, a track will work, but it is not as dynamic. Walking the inner planets takes little time. Walking to Jupiter and each of the other outer planets takes much longer. Encourage a different team of students to be in charge of counting the paces out loud for one planet. Marking the place of each planet with a weighted helium balloon is a good idea; you can see the balloons at a distance.

Part 3 allows students to learn details gathered by NASA spacecraft about the other planets in our solar system.

MATERIALS

Part 1—Exploring Planet Sizes

- Balloon (for the Sun model)
- Miniature marshmallows
- Poppy seeds
- Mustard seeds
- Circle-shaped cereal
- Popcorn kernels
- Dried peas
- 1-centimeter gum balls
- Black pepper
- Glue
- Model Planet Cards

Part 2—Walking Planet Distances

- Pins or masking tape
- Pencil
- Hard writing surface (to take outdoors)

Part 3

- Internet access

CONTENT RESEARCH

Review the bodies that comprise the solar system such as the Sun, asteroids, asteroid belts, comets, meteors, planets, Kuiper Belt, and Oort Cloud. Instruct students to define a planet. They may be surprised that it is more difficult than they think.

VOCABULARY:

Sun: The nearest star to earth that generates its energy by nuclear fusion, changing hydrogen atoms into helium by its intense gravity.
Asteroid: A class of small solar system bodies in orbit around the Sun and believed to be remnants of the solar system formation.
Asteroid Belt: An area or zone between the orbits of Mars and Jupiter where a large percentage of asteroids are in orbit around the Sun.
Comets: Solar system bodies consisting of ice and rock and believed to be remnants of the solar system formation.
Planets: Larger spherical bodies in the solar system in orbit around the Sun characterized by having a gravitational field to maintain their spherical shape.
Kuiper Belt: An area or zone beyond the orbit of Neptune where a large percentage of smaller bodies larger than asteroids and smaller-size planets are in orbit around the Sun.
Oort Cloud: An area or zone beyond the Kuiper Belt at the very edge of the solar system where a large percentage of comets are in orbit around the Sun.

LESSON ACTIVITIES

Exploring Planet Sizes: Students investigate planetary sizes by using models to represent planets in our solar system. Start on page 30 of this link: http://solarsystem.nasa.gov/educ/docs/3-stardst-ch03.pdf

Earth, Moon, Mars Balloons Activity: Construct a scale model of the Earth-Moon-Mars system in terms of planetary size and discover how far one might have to travel to get to the Moon or Mars.
http://www.nasa.gov/audience/foreducators/k-4/features/A_Earth_Moon_Mars_Balloons.html

Walking the Planet Distances: Students walk the distances among planets using meter measurements.
http://solarsystem.nasa.gov/educ/docs/3-stardst-ch03.pdf

Solar System Missions: Students research recent discoveries about our solar system using NASA Internet sites. http://discovery.nasa.gov/index.cfml

ADDITIONAL RESOURCES

Solar Systems Missions: An additional resource for learning about the latest discoveries of other planets. http://solarsystem.nasa.gov/missions/index.cfm

Solar System Lithograph Set: Features images of the planets, the Sun, asteroids, comets, meteors and meteorites, the Kuiper Belt and Oort Cloud, and moons of the solar system. General information, significant dates, interesting facts, and brief descriptions of the images are included.
Lithograph Set

DISCUSSION QUESTIONS

In the activity "Walking the Planet Distances," students can readily visualize in comprehending the size of the solar system. Since the activity requires that this size-model of the solar system be in a linear or "straight-line" configuration from the Sun, ask students what can be improved to make the model more realistic. *Students should come up with the recommendation that the scale model be allowed to show that planets do not travel around the Sun in a straight line, but are in separate orbits around the Sun. Planet markers should be positioned in a logical, concentric pattern from the Sun.*

ASSESSMENT ACTIVITIES

Provide students with an opportunity to discuss findings they discovered from the activities, paying close attention to the student's vocabulary and the context of how the words are used in their description of what they learned about Mars. Assign groups of students to develop a 5-minute PowerPoint presentation, incorporating digital pictures from the activities done outdoors as the students walked the solar system or made model representations of the different planets

ENRICHMENT

Encourage students to write a story of what it would be like to explore on the moons of Jupiter or Saturn making sure the students incorporate scientific knowledge of what we know about these satellites in their stories.

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